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SAMPLING AND ANALYSIS PLAN FOR ZONE G SITE 16 BUILDING 224 WITH TRANSMITTAL CNC CHARLESTON SC

12/1/2000

CH2M HILL

SAMPLING AND ANALYSIS PLAN
FOR
ZONE G/ SITE 16-BUILDING 224

SITE IDENTIFICATION # 01251

Charleston Naval Complex
Charleston, South Carolina

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND

Contract Number N62467-99-C-0960

December 2000

D H E C
PROMOTE PROTECT PROSPER
2600 Bull Street
Columbia, SC 29201-1708

9 February 2000

Department of the Navy
Southern Division NFEC
P.O. Box 190010
North Charleston, SC 29419-9010
Attention: Mr. Gabriel Magwood

Re: Final Assessment Report dated 30 December 1999
Zone G/Site 16-Building 224 (Site Identification # 01251)
Charleston Naval Complex/Charleston Naval Base
Charleston, SC
Charleston County

Dear Mr. Magwood:

The author has completed technical review of the referenced document. As submitted, the report provides a narrative describing previous assessment activities and analytical results from additional sampling conducted to determine the environmental fate of suspected contamination at the subject property. The analytical results provided indicate that reportable concentrations of BTEX and PAH compounds were detected above established method detection limits in soil and groundwater samples obtained at the subject site. The reported compounds are at a concentration(s) which is at or above the RBSL (Risk-Based Screening Levels, SCDHEC *Risk-Based Corrective Action for Petroleum Releases,* 5 January 1998), proposed RBC (Risk-Based Concentrations for Residential Soils, EPA Region III Risk-Based Concentrations Table, 12 April 1999) and/or established groundwater MCLs (maximum contaminant levels). Based on the analytical results presented and description of site specific geology/hydrogeology, it appears that a reasonable delineation of soil and groundwater contamination has been developed for the subject site and appropriate remedial action is warranted.

Please be reminded that the Department considers the goal of groundwater corrective actions as the restoration of impacted waters to the quality consistent with the use associated with the described class, unless a mixing zone within the bounds of the property is granted by the Department (R.61- 68 Water Classifications and Standards). As groundwaters of the State are currently classified as Class GB (underground sources of drinking water), the appropriate remedial goal for this site will be the quality standards established in R.61-68, if reasonably and technically attainable, utilizing available technology. The Department may consider intrinsic biodegradation/attenuation (natural attenuation) as a reasonable remedial strategy when demonstrated to be a viable and effective mechanism for restoration of groundwater quality.

JA Jones Environmental Services

TRANSMITTAL FORM

Project:	Charleston Naval Shipyard
DO Title:	Delivery Order '008
DO Project Location:	Charleston Naval Complex

Date: 11-Dec-00	**To:** Chuck Williams SCDHEC 2600 Bull Street Columbia . SC 29201-1708 803-898-4339	**From:** Brian R. Crawford J.A. Jones Environmental Services 2470 Mall Dr. Charleston, South Carolina 29406 (843) 746-8882
Contract Number :		
Delivery Order Number		
008		
File Number		
0		

JAJ Subcontract Number	**Subcontractor/Supplier/Manufacturer:**	**Transmitted for:**	
na		Approval/Comment	
JAJ P.O. Number		Final document	
na		Information	X
Change Order Number		As requested	X
na		Fabrication	
Transmittal Number		Field Use	
001-C008		Other	

Specification Section Number or Drawing	Qty	Description of Submittal	Date	Comments	Number of Copies
	1	CAP Zone H site 36 Bldg 640 (site # 00955)	12/11/00		1
	1	CAP Zone G site 16 Bldg 224 (site # 01251)	12/11/00		1

SENT		GENERAL COMMENTS
Enclosed	X	Original
Separate		
Fed Ex	X	
Mail		
Other		
Other		

CC: Project File
Gary Foster
Gabe Magwood
Tony Hunt

Signed: 12-11-00

Brian R. Crawford, Engineer II

The facility must provide appropriate and relevant technical justifications to demonstrate natural biodegradation/attenuation as a reasonable and effective corrective action and demonstrate the groundwater environment's assimilative capacity to provide for natural attenuation for CoC's (contaminants of concern) through time. Appropriate quantitative fate and transport calculations should be incorporated to demonstrate potential current risk (exposure) and potential future risk (exposure) to CoC originating from the site. Appropriate monitoring must be developed to demonstrate the rate and effectiveness of the suspected biodegradation process and demonstrate the validity of the assumptions employed in predictive modeling.

With consideration to the above discussion, the facility must develop and submit a CAP (corrective action plan) for review and approval, as appropriate. Please submit a schedule for completion of the requested CAP to my attention by 31 March 2000. Should you have any questions please contact me at (803) 898-3559.

Sincerely,

Paul L. Bristol, Hydrogeologist
Groundwater Quality Section
Bureau of Water

cc: Trident District EQC

CORRECTIVE AVTION PLAN
FOR
ZONE G/ SITE 16-BUILDING 224

SITE IDENTIFICATION # 01251

Charleston Naval Complex
Charleston, South Carolina

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
Charleston, South Carolina 29406

Submitted by:
CH2M-JONES, LLC.
115 Perimeter Center Place NE
Suite 700
Atlanta, Georgia 30346-1278

Contract Number: N62467-99-C-0960

December 2000

PREPARED BY:

BRC 12-7-00

Brian R. Crawford
Engineer II
CH2M-JONES, LLC.

APPROVED BY:

Jed A. Heames
Site Superintendent
CH2M-JONES, LLC.

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ACRONYMS AND ABBREVIATIONS

bls	below land surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene Isomers
CAP	Corrective Action Plan
CNC	Charleston Naval Complex
EISOPQAM	Environmental Investigations Standard Operating Procedures and Quality Assurance Manual
EPA	Environmental Protection Agency
ft	foot
mg/kg	microgram per kilogram
mg/L	microgram per liter
OVA	Organic Vapor Analyzer
QA	Quality Assurance
QC	Quality Control
RBSL	Risk-Based Screening Level
RDA	Redevelopment Authority
SCDHEC	South Carolina Department of Health and Environmental Control
SOUTHDIV	Southern Division Naval Facilities Engineering Command
SSTL	Site-Specific Target Level
TTNUS	Tetra Tech NUS
UST	Underground Storage Tank

Notes

1.0 INTRODUCTION

This Corrective Action Plan (CAP) has been prepared by CH2M-JONES, LLC. The plan is designed for Zone G/ Site 16-Building 224; Underground Storage Tank (UST) 224 located at the Charleston Naval Complex (CNC), Charleston, South Carolina.

The South Carolina Department of Health and Environmental Control (SCDHEC) has designated this site as Identification Number: 01251. This CAP provides methods to further evaluate the applicability of intrinsic remediation and monitoring well abandonment as a corrective action for UST 224 in accordance with SCDHEC Corrective Action Guidance, June 1997.

1.1 General Site Description

The CNC is in the city of North Charleston, on the west bank of the Cooper River in Charleston County, South Carolina as shown in Figure 1. This installation consists of two major areas: an undeveloped dredge materials area on the east bank of the Cooper River on Daniel Island in Berkley County, and a developed area on the west bank of the Cooper River. The developed portion of the base is on the peninsula bounded on the west by the Ashley River and on the east by the Cooper River. The site is located within the developed portion of the base as shown in Figure 2. (Tetra Tech, NUS [TTNUS], Rapid Assessment [RA] for UST 224, December 1999).

The area surrounding CNC is "mature urban", having long been developed with commercial, industrial, and residential land use. Commercial areas are primarily west of CNC; industrial areas are primarily to the north of the base along Shipyard Creek. A site vicinity map, which exhibits adjacent properties and structures, vicinity roads, current utilities, and vicinity surface drainage, is included as Figure 2.

Building 224 was used as a submarine supply and a base supply warehouse known as Servmart. It was constructed in 1972 on previously undeveloped land. UST 224 was a 5,000-gallon steel tank which supplied heating fuel for the buildings boiler. The UST was installed in 1972 and was an underground tank placed directly into the soil. The UST was located on the southeast corner of Building 224 (Figure 3). The UST system was last in operation in March 1996. On August 18, 1998, UST 224 was removed, cleaned, and recycled as scrap metal. At the time of the UST removal, no corrosion, pitting, or holes were found in the tank. The UST was coated with a 3/8 inch thick layer of pitch. The UST system piping was constructed of steel and copper and ran from the vault to the building, located approximately 20 feet west of the UST. The piping from the UST to the building was removed during the closure (TTNUS, 1999).

1.2 Objective

In the Rapid Assessment (RA) completed by Tetra Tech NUS, seven soil samples were collected and sampled for Benzene, Toluene, Ethylbenzene, and Xylene (BTEX), MtBE and EDB using method 8260 and PAHs and Naphthalene using method 8270 and total

recoverable petroleum hydrocarbons (TPH) using method 9071A. Naphthalene was found in two soil samples, CNC16-B03 (14 ug/kg), and CNC-16-B04 (52,600 ug/kg). Naphthalene was the only Chemical of Concern (COC) found above the Risk Based Screening Levels (RBSLs) for soils at the site. Six groundwater samples were collected at the site. The groundwater samples were analyzed for BTEX, MtBE, and EDB using 8260, and PAHs using method 8270. Naphthalene was found in two groundwater samples, CNC16M01 (11 ug/L), CNC16M-02 (19 ug/L) which are both above groundwater RBSLs of 10 ug/L. Benzene was found in one groundwater sample, CNC16M-01 (8 ug/L) which is also above RBSLs of 5 ug/L.

This CAP presents the groundwater monitoring plan to attempt to demonstrate the ground water's assimilative capacity to provide for intrinsic biodegradation/ natural attenuation for the known contaminates through time in order to validate the assumptions and calculations used in the RA completed by TTNUS 1999.

Notes

2.0 RECEPTOR SURVEY

A receptor survey of the site vicinity was conducted by TTNUS to identify potential receptors for petroleum hydrocarbon contamination. Figure 2 depicts the public utilities located within 250 feet of the former UST 224 study area. Specific information concerning the depth of utilities below land surface (bls) is currently unavailable, however, utilities at this site generally are between 2 to 6 feet (ft) bls. The following utility receptors were located:

UTILITY	ON-SITE OR DISTANCE/ DIRECTION FROM SITE	DEPTH TO UTILITY
Gas	None within 250 feet	2-6-ft bls
Electrical	100 feet south of UST 224	Overhead and 2-6-ft bls
Sewer	None within 250 feet	2-6-ft bls

According to the RA report completed by TTNUS, a survey of groundwater users within a 7-mile radius of CNC was conducted by the South Carolina Water Resources Commission to ascertain the extent of any shallow groundwater usage. Results of the water use investigation revealed that no drinking water wells, which utilize the shallow aquifer, are located within a 4 mile radius of CNC. Irrigation wells are not identified within 1,000 feet of the site. Numerous monitoring wells are located within 1,000 feet of the site. The nearest surface water body to the site is the Cooper River located approximately 1,100 feet from the site (TTNUS, 1999).

2.1 Fate and Transport Modeling

The Dominico model was the fate and transport model used to determine groundwater site-specific target levels (SSTLs) in the risk analysis. The Dominico dilution/attenuation model is presented in the SCDHEC guidance document, *South Carolina Risk-Based Corrective Action for Petroleum Releases* (SCDHEC, 1988). This model is very conservative in that is assumes an infinite mass, aerial source condition through which groundwater flows. The model incorporates biological decay effects through a first-order decay process; however, this mechanism was ignored because SCDHEC guidance specifies that the decay rate must be assumed to be zero if site-specific decay rates have not been determined.

The impacted groundwater source area was modeled as 50 feet (15 meters) wide and 6.56 feet (2 meters) deep; these values are conservative defaults suggested by the American Society for testing and Materials (ASTM) *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (ASTM 1997). The maximum source concentrations are assumed to exist throughout the source area, further compounding the conservatism of the estimate. The maximum concentrations of benzene and naphthalene were 8 ug/L and 19 ug/L, respectively.

Notes

3.0 PROPOSED REMEDIATION TECHNOLOGY

Based on the results of the RA modeling, an Intrinsic Remediation with a monitoring period of 9 months will be performed for the site. The monitoring program will consist of sampling initially a total of seven surrounding wells adjacent to the source point, and only sampling three selected wells thereafter. The proposed monitoring program is described in detail in Sections 4.0 and 5.0 of this plan. In order to support monitored natural attenuation for this site, CH2M-Jones, LLC must provide sufficient data to demonstrate the groundwater environment's assimilative capacity to provide for intrinsic biodegradation/ natural attenuation for the known contaminates through time. As stated in Section 1.2, the known contaminate is naphthalene and benzene. All other contaminates are below the RBSLs. In addition to sampling the known contaminate, several other intrinsic parameters will be measured to support intrinsic biodegradation/ natural attenuation. As a general guidance, biodegradation of petroleum hydrocarbons most commonly occurs by means of aerobic, nitrate-reducing, Fe(III)-reducing, sulfate-reducing, and methanogenic respiration as noted in the following tables (Parsons Engineering Science, Inc. and USGS, 1998).

Trends in Contaminant, Electron Acceptor, and Metabolic Byproduct Concentrations During Biodegradation

Analyte	Trend in Analyte Concentrations During Biodegradation	Terminal Electron Accepting Process Causing Trend
Petroleum Hydrocarbons	Decrease	Aerobic respiration, denitrification, Mn (IV) reduction, Fe (III) reduction, sulfate reduction, methanogenesis
Highly Chlorinated Solvents and Daughter Products	Parent compound concentrations decrease, daughter products increase initially and then may decrease	Reductive dechlorination and cometabolic oxidation
Lightly Chlorinated Products	Decrease	Aerobic respiration and Fe (III) reduction (direct oxidation) and cometabolism (indirect oxidation)
Dissolved Oxygen	Decrease	Aerobic respiration
Nitrate	Decrease	Denitrification
Mn (II)	Increase	Mn (IV) reduction
Fe (II)	Increase	Fe (III) reduction
Sulfate	Decrease	Sulfate reduction
Methane	Increase	methanogenesis
Chloride	Increase	Reductive dechlorination or direct oxidation of chlorinated compound
Oxidation/ Reduction Potential	Decrease	Aerobic respiration, denitrification, Mn (IV) reduction, Fe (III) reduction, sulfate reduction, methanogenesis and halorespiration
Dissolved Inorganic Carbon	Increase	Aerobic respiration, denitrification, Fe (III) reduction, and sulfate reduction

Notes

4.0 MONITORING WELL INSTALLATION AND ABANDONMENT

4.1 Monitoring Well Installation

Because of the amount of monitoring wells located in and around this site, no monitoring wells will be installed as part of this plan.

4.2 Monitoring Well Abandonment

All monitoring wells will be abandoned at Building 224 following the South Carolina Well Standards and Regulations R.61-71. The well abandonment will include grouting wells, removing stick-ups and removing all guard posts. Monitoring well abandonment will not be performed until this site is warranted closed as No Further Action by SCDHEC.

4.3 Surveying

Because no monitoring wells will be installed at this site, a new survey will not be conducted.

4.4 Equipment Decontamination

All drilling equipment, augers, well casing and screens, and soil and groundwater sampling equipment involved in field sampling activities will be decontaminated according to the Environmental Protection Agencies (EPA) " Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM).

Notes

5.0 PROPOSED GROUNDWATER MONITORING PROGRAM

5.1 Monitoring Frequency and Reporting

The groundwater monitoring program proposed at Building 224 will be performed in accordance with SCDHEC Corrective Action Guidance, June 1997, and consist of the following:

Sampling date or (Quarter)	Monitoring Wells Sampled	Field Measures	Laboratory Analytical
First quarter [1] 2001	CNC-16M01, CNC-16M02 CNC-16M03, CNC-16M04 CNC-16M05, CNC-16M06 CNC-16M07D	T°, pH, DO, Conductivity, Depth to water, Total depth, Turbidity	Naphthalene 8260 BTEX 8260 In addition MW-01, MW-02 will be sampled for Nitrate, sulfate, total dissolved iron, methane, alkalinity
Second quarter [2] 2001	CNC-16M01 CNC-16M02 CNC-16M07	T°, pH, DO, Conductivity, Depth to water, Total depth, Turbidity	Naphthalene 8260 BTEX 8260 Nitrate, sulfate, total dissolved iron, methane, alkalinity
Third quarter [3] 2001	CNC-16M01 CNC-16M02 CNC-16M07D	T°, pH, DO, Conductivity, Depth to water, Total depth, Turbidity	Naphthalene 8260 BTEX 8260 Nitrate, sulfate, total dissolved, methane, alkalinity

1. First quarter is defined as January February and March.
2. Second quarter is defined as April May and June
3. Third quarter is defined as July, August, and September

- **Frequency:** Initially all monitoring wells at this site will be sampled. Thereafter, groundwater samples will be collected from wells MW-01, MW-02, and MW-07.

- **Reporting:** Semi-annual groundwater monitoring reports will be submitted to SCDHEC.

Included in the semi-annual reports will be field and analytical information from the certified laboratory indicating well numbers, analytical methods used, date sampled, date analyzed, and method detection limits.

At the end of the third quarter 2001 period, (or as necessary) a performance evaluation will be submitted to SCDHEC providing the effectiveness of the intrinsic biodegradation/natural attenuation occurring and any recommendations for the site if needed. It is possible that the levels are not above the RBSLs in the groundwater, which will result in a different approach to the closure of these tanks.

- **Groundwater Sampling**

Prior to any groundwater sampling, each well will be measured for water levels and total depth and each well will be purged in accordance the EPA EISOPQAM.

5.2 Analytical Parameters

The following constituents will be analyzed for each groundwater sample:

- Naphthalene using method 8260
- BTEX using method 8260

The following parameters will be analyzed in order to evaluate the effectiveness of intrinsic remediation (refer to Section 3.0 for guidance and trends on intrinsics):

- Nitrate (NO^{-3})
- Sulfate (SO^{-4})
- Total Dissolved Iron
- Methane (CH_4)
- Alkalinity

5.3 Field Measurements

The following parameters will be sampled in the field:

- Temperature
- pH
- Dissolved Oxygen
- Depth to water table
- Depth of well
- Turbidity
- Specific Conductance

Field measurements will be recorded in the field book and in field forms.

5.4 Groundwater Level Measurements

Groundwater measurements will be taken from all monitoring wells at the site during each sampling event. All water level measurements will be taken on the same day as anticipated sampling.

Measurements will be taken with an electrical water level meter or interface probe if floating product is present using the highest part of the top of the casing as a reference point for determining depths to water and total depths. Water level measurements will be recorded to the nearest 0.01-foot in the field book.

5.5 Sample Handling

Field procedures and groundwater analysis will follow standard procedures found in the approved Corrective Action Sampling and Analysis Plan (CSAP) portion of the RFI Work Plan (Ensafe, Inc./ Allen & Hoshall, 1996). The CSAP outlines all monitoring procedures to be performed in during the investigation in order to characterize the environmental setting, source, and releases of hazardous constituents. In addition, the CSAP includes the Quality Assurance plan and Data Management Plan to verify that all information and data are valid and properly documented. Unless otherwise noted, the sampling strategy and procedures will be performed in accordance with the EPA Environmental Services Division

Sample Handling will be conducted in accordance with the following references:

EPA EISOPQAM (EPA May, 1996)
Comprehensive Sampling and Analysis Plan(Ensafe/Allen & Hoshall July, 1996)

5.6 Sample Packing and Shipping

The following forms will be compiled to complete the packing/shipping process:

- Sample labels
- Chain-of-custody labels
- Appropriate labels applied to shipping coolers
- Chain-of-custody forms
- Federal express air bills

5.7 Quality Check

Quality Control (QC) samples will be collected during sampling events. QC samples may include field blanks, field duplicates, and trip blanks. Definitions of each can be found below as described by the EISOPQAM:

- **Field Blank:** a sample collected using organic-free water, which has been run over/through sample collection equipment. These samples are used to determine if contaminants have been introduced by contact of the sample medium with sampling equipment. Equipment field blanks are often associated with collecting rinse blanks of equipment that has been field cleaned.

- **Field Duplicates:** Two or more samples collected from a common source. The purpose of a duplicate sample is to estimate the variability of a given characteristic or contamination associated with a population.

- **Trip Blank:** A sample, which is prepared prior to the sampling event in the actual container and is stored with the investigative samples throughout the sampling event. They are often packaged for shipment with the other samples and submitted for analysis. At no time after their preparation are trip blanks to be opened before they reach the laboratory. Trip blanks are used to determine if samples were contaminated during storage and/or transportation back to the laboratory (a measure of sample handling variability resulting in positive bias in contaminant concentration). If samples are to be shipped, trip blanks are to be provided with each shipment but not for each cooler.

5.8 Control Limits

Analysis	Control Parameter	Control Limit	Corrective Action
Air Monitoring	Check Calibration of OVA daily	Calibrate to manufactures specifications	Recalibrate. If unable to calibrate, replace.
pH of water	Continuing calibration check of pH 7.0 buffer	pH= 7.0	Recalibrate. If unable to calibrate, replace electrode.
Specific Conductance of water	Continuing calibration check of standard solution	> 1% of standard	Recalibrate.

5.9 Record keeping

In addition to records kept in logbooks, forms will be kept on log sheets for soil and groundwater.

5.10 Site Management and Base Support

Throughout the investigation activities, work on the CNC will be coordinated through SOUTHDIV and SCDHEC.

The primary contacts for each are as follows:

1. SOUTHDIV point of contact
   Gabe Magwood
   Southern Division Engineering Command
   2155 Eagle Drive
   North Charleston, SC 29406
   (843) 820-7307

2. SOUTHDIV point of contact
   Tony Hunt
   Southern Division Engineering Command
   2155 Eagle Drive
   North Charleston, SC 29406
   (843) 820-5525

3. SCDHEC point of contact
   Chuck Williams
   South Carolina Department of Health and Environmental Control
   2600 Bull Street
   Columbia, SC 29201
   (843) 898-3559

REFERENCES

Ensafe/ Allen & Hoshall. July, 1996. Comprehensive Sampling and Analysis Plan.

Parsons Engineering Science, Inc. and United States Geological Survey. September 1998. Technical Guidelines for Evaluating Monitored Natural Attenuation of Petroleum Hydrocarbons and Chlorinated Solvents in Ground Water at Naval and Marine Corps Facilities.

South Carolina Department of Health and Environmental Control. 1997. Corrective Action Guidance.

Tetra Tech NUS, Inc.; 1999 Rapid Assessment for Site 16 (Building 224), Charleston, South Carolina.

United States Environmental Protection Agency. 1990. Code of Federal Regulations 136.

United States Environmental Protection Agency. 1988. EPA Users Guide to Contract Laboratory Program.

United States Environmental Protection Agency. 1996. EPA Environmental Investigations Standard Operating Procedures for Quality Assurance Manual.

Notes

TABLE 1

GROUNDWATER ELEVATIONS
SITE 16, BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA
PAGE 1 OF 1

Well #	Total Depth of Well, ft	Top of Casing Elevation, ft (MSL)	Date Measured	Depth to Water, ft (BTOC)	Depth to Product, ft (BTOC)	Product Thickness, ft	Groundwater Elevation (MSL)
CNC16-M01	12.5	7.03	7/22/99	1.56	ND	ND	5.47
			9/11/99	2.62	ND	ND	4.41
CNC16-M02	12.5	6.64	7/21/99	1.32	ND	ND	5.32
			9/11/99	2.22	ND	ND	4.42
CNC16-M03	12.5	6.07	7/22/99	0.51	ND	ND	5.56
			9/11/99	1.66	ND	ND	4.41
CNC16-M04	12.5	5.97	7/21/99	0.61	ND	ND	5.36
			9/11/99	1.58	ND	ND	4.39
CNC16-M05	12.5	5.60	7/21/99	0.28	ND	ND	5.32
			9/11/99	1.23	ND	ND	4.37
CNC16-M06	12.5	6.45	7/22/99	0.91	ND	ND	5.54
			9/11/99	1.91	ND	ND	4.54
CNC16-M07D	35.0	6.80	7/22/99	NM	NM	NM	NM
			9/11/99	0.95	ND	ND	5.85

Notes:

MSL - Mean Sea Level
BTOC - Below Top of Casing
NM - Not Measured
ND- No Free Product Detected
ft - Feet

TABLE 2

GROUNDWATER FIELD MEASUREMENTS
SITE 16, BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Well I.D.	Date Sampled	Purge method	Volume (gallons)	Temp. (°C)	pH	Conductivity (uMHOS/cm)
CNC16-M01	7/22/99	PP	5.3	24.7	6.91	23.3
CNC16-M02	7/21/99	PP	5.3	25.9	7.05	9.1
CNC16-M03	7/22/99	PP	5.7	28.8	7.28	2.1
CNC16-M04	7/21/99	PP	5.8	30.1	7.26	11.1
CNC16-M05	7/21/99	PP	5.9	30.3	7.18	11.3
CNC16-M06	7/22/99	PP	5.5	27.7	7.38	7.6
CNC16-M07D	9/12/99	PP	7.5	24.9	8.00	19.0

Notes:
(°C) - Degrees Celsius
PP - Peristaltic pump, low flow technique
uMHOS/cm - Micro MHOS per centimeter

TABLE 3

SUMMARY OF OVA SOIL SCREENING RESULTS
SITE 16, BUILDING 224
ZONE G, FORMER CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Sample Location	Sample Identification	Sample Depth (feet)	Total Organic Vapor Headspace Concentration (ppm)
CNC16-B01	16SSB0102	2	>50
	16SSB0103	3	>100
	16SSB0104	4	>100
CNC16-B02	16SSB0201	1	10
	16SSB0202	2	1000
	16SSB0203	3	1000
	16SSB0205	5	1000
CNC16-B03	16SSB0303	3	>100
	16SSB0304	4	>100
	16SSB0305	5	>100
	16SSB0306	6	>100
CNC16-B04	16SSB0402	2	50
	16SSB0403	3	>100
CNC16-B05	16SSB0501	1	4
	16SSB0502	2	>100
	16SSB0503	3	50
	16SSB0504	4	50
	16SSB0505	5	>1000
	16SSB0506	6	>1000
	16SSB0507	7	>1000
CNC16-B06	16SSB0601	1	5
	16SSB0602	2	5
	16SSB0603	3	50
	16SSB0604	4	50
CNC16-B07	16SSB0703	3	3
	16SSB0704	4	5
CNC16-B08	16SSB0801	1	3
	16SSB0802	2	3
	16SSB0803	3	3
	16SSB0804	4	3
CNC16-B09	16SSB0901	1	3
	16SSB0902	2	3
	16SSB0903	3	20
	16SSB0904	4	20

Notes:

OVA - organic vapor analyzer equipped with a flame ionization detector
PPM - parts per million
ND - not detected

TABLE 3

SUMMARY OF OVA SOIL SCREENING RESULTS
SITE 16, BUILDING 224
ZONE G, FORMER CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Sample Location	Sample Identification	Sample Depth (feet)	Total Organic Vapor Headspace Concentration (ppm)
CNC16-B10	16SSB1001	1	3
	16SSB1002	2	3
	16SSB1003	3	50
	16SSB1004	4	50
CNC16-B11	16SSB1101	1	2
	16SSB1102	2	2
	16SSB1103	3	2
	16SSB1104	4	2
CNC16-B12	16SSB1201	3	>100
	16SSB1202	4	>100
CNC16-B13	16SSB1301	1	2
	16SSB1302	2	2
	16SSB1303	3	2
CNC16-B14	16SSB1401	1	3
	16SSB1402	2	15
	16SSB1403	3	>100
CNC16-B15	16SSB1501	1	ND
	16SSB1502	2	ND
CNC16-MW-7D	16SSB1601	1	ND

Notes:

OVA - organic vapor analyzer equipped with a flame ionization detector
PPM - parts per million
ND - not detected

TABLE 4

SUMMARY OF MOBILE LABORATORY SCREENING RESULTS FOR SOIL
SITE 16, BUILDING 224
ZONE G, FORMER CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Sample Location	Sample Identification	Sample Depth (feet)	Laboratory Screening Data (PPB)[1]					
			Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	Diesel Range Organics
CNC16-B01	16SFB01-0304	2-3	<5.0	<5.0	17	53	510	33
CNC16-B01[2]	16SFB01-0304	2-3	<5.0	<5.0	6.3	43	480	NA
CNC16-B02	16SFB02-0304	2-3	<5.0	<5.0	<5.0	15	19000	270
CNC16-B03	16SFB03-0304	3-4	<5.0	<5.0	<5.0	<5.0	64	44
CNC16-B04	16SFB04-0304	3-4	34	20	320	2110	39000	360
CNC16-B05	16SFB05-0203	2-3	<5.0	<5.0	<5.0	<5.0	3800	<10
CNC16-B06	16SFB06-0304	3-4	<5.0	<5.0	<5.0	<5.0	<5.0	<10
CNC16-B07	16SFB07-0304	3-4	<5.0	<5.0	<5.0	<5.0	<5.0	19
CNC16-B08	16SFB08-0304	3-4	<5.0	<5.0	<5.0	<5.0	<5.0	<10
CNC16-B09	16SFB09-0304	3-4	<5.0	<5.0	<5.0	<5.0	<5.0	<10
CNC16-B10	16SFB10-0304	3-4	<5.0	<5.0	<5.0	<5.0	<5.0	<10
CNC16-B11	16SFB11-0304	3-4	<5.0	<5.0	<5.0	<5.0	<5.0	<10
CNC16-B14	16SFB14-0304	3-4	<5.0	<5.0	<5.0	<5.0	<5.0	<10
CNC16-B14[2]	16SFB14-1011	3-4	<5.0	NA	NA	NA	NA	<10

NOTES:
[1] Laboratory screening data were analyzed using USEPA Method 8260. Compounds not detected are reported as less than the instrument detection limit.
[2] Duplicate sample
PPB - parts per billion

TABLE 5

SUMMARY OF MOBILE LABORATORY SCREENING RESULTS FOR GROUNDWATER
SITE 16, BUILDING 224
ZONE G, FORMER CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Sample Location	Sample Identification	Laboratory Screening Data (PPB)[1]					
		Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	Diesel Range Organics
CNC16-B01	16GFB01-10	<1.0	<1.0	<1.0	1.1	290	6.5
CNC16-B02	16GFB02-09	10	<1.0	<1.0	<1.0	690	1.2
CNC16-B03	16GFB03-12	<5.0	<5.0	<5.0	<5.0	64	15
CNC16-B03[2]	16GFB03-12	NA	NA	NA	NA	NA	16
CNC16-B04	16GFB04-12	27	2.3	<1.0	1.1	280	1.7
CNC16-B04[2]	16GFB04-12	6.4	<1.0	<1.0	<1.0	170	NA
CNC16-B05	16GFB05-12	89	1.8	2.5	10.4	84	0.3
CNC16-B06	16GFB06-12	<1.0	<1.0	<1.0	<1.0	<1.0	0.2
CNC16-B07	16GFB07-08	<1.0	<1.0	<1.0	<1.0	22	12
CNC16-B07[2]	16GFB07-08	<1.0	<1.0	<1.0	<1.0	44	NA
CNC16-B08	16GFB08-08	<1.0	<1.0	<1.0	<1.0	<1.0	0.8
CNC16-B09	16GFB09-08	<1.0	<1.0	<1.0	<1.0	<1.0	0.2
CNC16-B10	16GFB10-08	3	1.3	6.3	82	1800	14
CNC16-B11	16GFB11-08	<1.0	<1.0	<1.0	<1.0	<1.0	0.3
CNC16-B12	16GFB12-08	<1.0	<1.0	<1.0	<1.0	<1.0	0.2
CNC16-B13	16GFB13-07	<1.0	<1.0	<1.0	<1.0	29	0.1
CNC16-B14	16GFB14-08	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1

NOTES:
[1] Laboratory screening data were analyzed using USEPA Method 8260. Compounds not detected are reported as less than the instrument detection limit.
[2] Duplicate sample
PPB - parts per billion
NA = Not analyzed

TABLE 6

SUMMARY OF FIXED-BASE LABORATORY ANALYTICAL RESULTS FOR CHEMICALS OF CONCERN IN SOIL
SITE 16, BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Soil Boring / Sample No.	Sample Date	Benzene (ug/kg)	Toluene (ug/kg)	Ethyl-benzene (ug/kg)	Xylenes (total) (ug/kg)	Benzo(a) anthracene (ug/kg)	Benzo(b) fluoranthene (ug/kg)	Benzo(k) fluoranthene (ug/kg)	Chrysene (ug/kg)	Dibenzo(a,h) anthracene (ug/kg)	Naphthalene (ug/kg)
RBSL [1]		5	478	364	1119	17687	7042	5593	3146	21265	52
CNC16-B01 / 16SLB010203	17-May-99	< 5	< 5	< 5	< 5	< 430	< 430	< 430	< 430	< 430	< 5
CNC16-B02 / 16SLB020203	17-May-99	< 6	< 6	< 6	< 6	< 430	220 [J]	< 430	240 [J]	< 430	4 [J]
CNC16-B02 / 16SLB020203D	17-May-99	< 6	< 6	< 6	< 6	< 430	< 430	< 430	< 430	< 430	4 [J]
CNC16-B03 / 16SLB030304	14-May-99	< 7	< 7	< 7	< 7	< 460	< 460	< 460	< 460	< 460	14.00
CNC16-B04 / 16SLB040304	14-May-99	< 6	< 6	7.00	< 6	< 4600	< 4600	< 4600	< 4600	< 4600	52600.00
CNC16-B05 / 16SLB050203	17-May-99	< 6	< 6	< 6	< 6	< 430	< 430	< 430	< 430	< 430	< 6
CNC16-B06 / 16SLB060304	14-May-99	< 5	< 5	< 5	< 5	< 460	< 460	< 460	< 460	< 460	< 5
CNC16-B10 / 16SLB100304	14-May-99	< 6	< 6	< 6	< 6	< 430	< 430	< 430	< 430	< 430	< 6
CNC01TL00103	03-May-99	< 5	<5	<5	<5	NS	NS	NS	NS	NS	<5
CNC02TL00201	13-May-99	< 5	<5	<5	<5	NS	NS	NS	NS	NS	<5

All concentrations are in micrograms per kilograms (ug/kg).

NA - Not Analyzed

NS = Not Sampled

[1] South Carolina Department of Health and Environmental Control Risk Based Screening Levels for clayey soils; depth to groundwater less than 5 feet.

[2] Trip blank

[J] Indicates the presence of an analyte at a concentration less than the reporting limit and greater than the detection limit.

TABLE 7

SUMMARY OF FIXED-BASE LABORATORY ANALYTICAL RESULTS FOR CHEMICALS OF CONCERN IN GROUNDWATER
SITE 16, BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Monitoring Well/ Sample No.	Sample Date	Benzene (ug/L)	Ethyl-benzene (ug/L)	Toluene (ug/L)	Xylenes (total) (ug/L)	Naphthalene (ug/L)	Benzo(a) anthracene (ug/L)	Benzo(b) fluoranthene (ug/L)	Benzo(k) fluoranthene (ug/L)	Chrysene (ug/L)	Dibenzo(a,h) anthracene (ug/L)	MTBE (ug/L)
RBSL[1]		5	700	1000	10000	10 [2]	10 [2]	10 [2]	10 [2]	10 [2]	10 [2]	40
CNC16M-01 / 16GLM0101	21-Jul-99	8	< 5	< 5	< 5	11 [J]	< 10	< 10	< 10	< 10	< 10	< 5
CNC16M-02 / 16GLM0201	21-Jul-99	< 5	3 [J]	< 5	< 5	18 [J]	< 10	< 10	< 10	< 10	< 10	< 5
CNC16M-02 / 16GLM0201D	21-Jul-99	< 5	3 [J]	< 5	< 5	19 [J]	< 10	< 10	< 10	< 10	< 10	< 5
CNC16M-03 / 16GLM0301	21-Jul-99	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	< 10	< 10	< 5
CNC16M-04 / 16GLM0401	21-Jul-99	3 [J]	< 5	< 5	< 5	3 [J]	< 10	< 10	< 10	< 10	< 10	< 5
CNC16M-05 / 16GLM0501	21-Jul-99	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	< 10	< 10	< 5
CNC16M-06 / 16GLM0601	21-Jul-99	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	< 10	< 10	< 5
CNC16M-07D / 16GLM7D01	12-Sep-99	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	< 10	< 10	< 5
CNC16-TL[3] / 16TL00601	21-Jul-99	< 5	< 5	< 5	< 5	< 5	NA	NA	NA	NA	NA	< 5

All concentrations are in ug/L.

NA - Not analyzed

(1) South Carolina Department of Health and Environmental Control Risk Based Screening Levels for ground water.

(2) The Risk based screening level for individual PAH CoC is 10 ug/l or 25 ug/l for total PAHs.

(3) Trip blank

(J) Indicates presence of analyte at a concentration less than the reporting limit and greater than the detection limit.

TABLE 8

FATE AND TRANSPORT INPUT PARAMETERS
SITE 16, BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Parameter	Domenico Dilution/Attenuation Model[1]
Hydraulic Conductivity [m/sec]	1.31E-06
Hydraulic Gradient [ft/ft]	0.0033
Porosity	0.53
Estimated Plume Length [ft]	NA
Soil Bulk Density [kg/L]	1.25
Fractional Organic Carbon	0.002
First Order Decay Rate [a] [sec^{-1}]	0
Modeled Plume Length [ft]	NA
Modeled Plume Width [ft]	NA
Source Width [ft] [a]	15
Source Thickness [ft] [a]	2
soluble Mass [kg]	Infinite[b]

(1) - *South Carolina Risk-Based Corrective Action for Petroleum Releases* South Carolina Department of Health and Environmental Control, 1988.

(a) - Stated values are default values.

(b) - Assumption of the Domenico Model.

See SCDHEC guidance for chemical-specific partition coefficient (k_{oc}) values.

TABLE 9

COMPARISON OF MAXIMUM CONCENTRATIONS TO RBSLs
SITE 16, BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Chemical of Concern	Maximum Concentration (Soil) (mg/kg)	RBSLs (Soil) (mg/kg)[a]	Maximum Concentration (GW) (mg/L)	RBSLs (GW) (mg/L)[b]
Benzene	< 0.007	0.005	**0.008**	0.005
Toluene	< 0.007	0.478	< 0.005	1
Ethylbenzene	0.007	0.364	0.003	0.7
Xylenes	< 0.007	11.119	< 0.005	10
MTBE	NA	NA	< 0.005	0.04
Naphthalene	**52.6**	0.052	**0.019**	0.010

(a) - From Risk-Based Corrective Action for Petroleum Releases, Table B4, Depth to GW - <5 ft, SCDHEC RBCA Guidelines, 1998.
(b) - From Risk-Based Corrective Action for Petroleum Releases, Table B1, SCDHEC RBCA Guidelines, 1998.
GW - Groundwater
RBSLs - Risk Based Screening Levels
Shaded cell indicates the concentration exceeded the RBSL.

TABLE 10

EXPOSURE PATHWAY ASSESSMENT - CURRENT LAND USE
SITE 16, BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Media	Exposure Route	Pathway Selected for Evaluation? (Yes or No)	Exposure point or Reason for Non-Selection	Data Requirements (If pathway selected)
Air	Inhalation	No	Area of Building 224 below grade is above water table and not expected to act as a basement. No explosion hazard.	
	Explosion Hazard	No		
Groundwater	Ingestion	No	No current groundwater pathways complete. Drinking water provided by city.	
	Dermal contact	No		
	Inhalation	No		
Surface Water	Ingestion	No	No surface water bodies within 1,000 feet	
	Dermal contact	No		
	Inhalation	No		
Surficial Soil	Ingestion	No	No surficial soil impact.	
	Dermal contact	No		
	Inhalation	No		
Subsurface Soil	Ingestion	No	No current complete pathways.	
	Dermal contact	No		
	Inhalation	No		

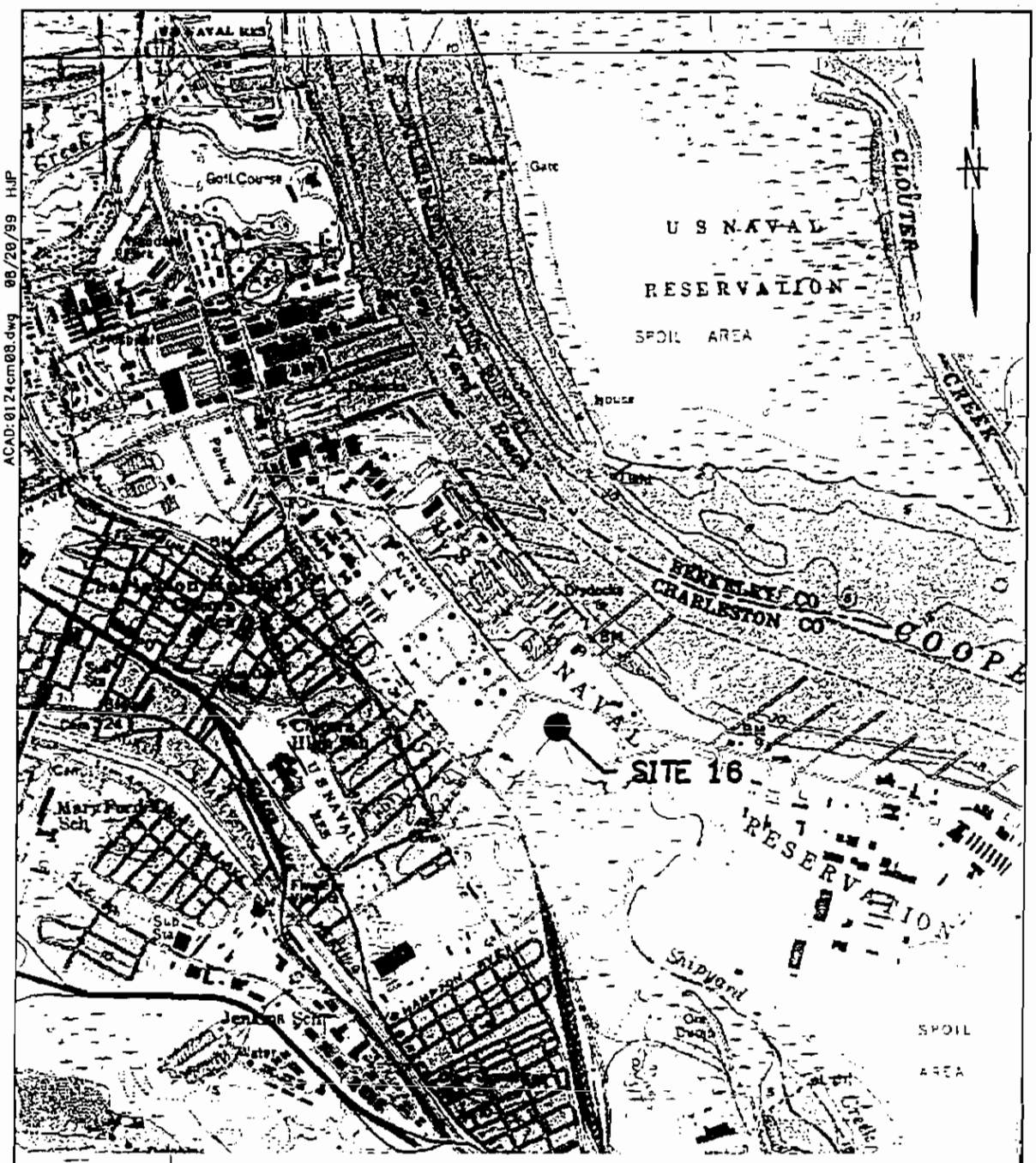
TABLE 11

EXPOSURE PATHWAY ASSESSMENT - FUTURE LAND USE
SITE 16, BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Media	Exposure Route	Pathway Selected for Evaluation? (Yes or No)	Exposure Point or Reason for Non-Selection	Data Requirements (If pathway selected)
Air	Inhalation	No	Area of Building 224 below grade is above water table and not expected to act as a basement. No explosion hazard.	
	Explosion Hazard	No		
Groundwater	Ingestion	Yes	Groundwater exposure by potential construction worker (most likely in utility corridor). Both direct exposure and exposure by soil leaching to groundwater evaluated.	No additional data needed.
	Dermal contact	Yes		
	Inhalation	Yes		
Surface Water	Ingestion	No	No surface water bodies within 1,000 feet.	
	Dermal contact	No		
	Inhalation	No		
Surficial Soil	Ingestion	No	Volatilization of CoCs will occur before receptor enters the trench to work.	No additional data needed.
	Dermal contact	No		
	Inhalation	No		
Subsurface Soil	Ingestion	Yes	Soil exposure by potential construction worker (most likely in utility corridor). Although there is no surficial soil impact, subsurface soil evaluated as surface soil for construction worker as direct contact likely in utility trench.	
	Dermal contact	Yes		
	Inhalation	No		

FIGURES

Notes



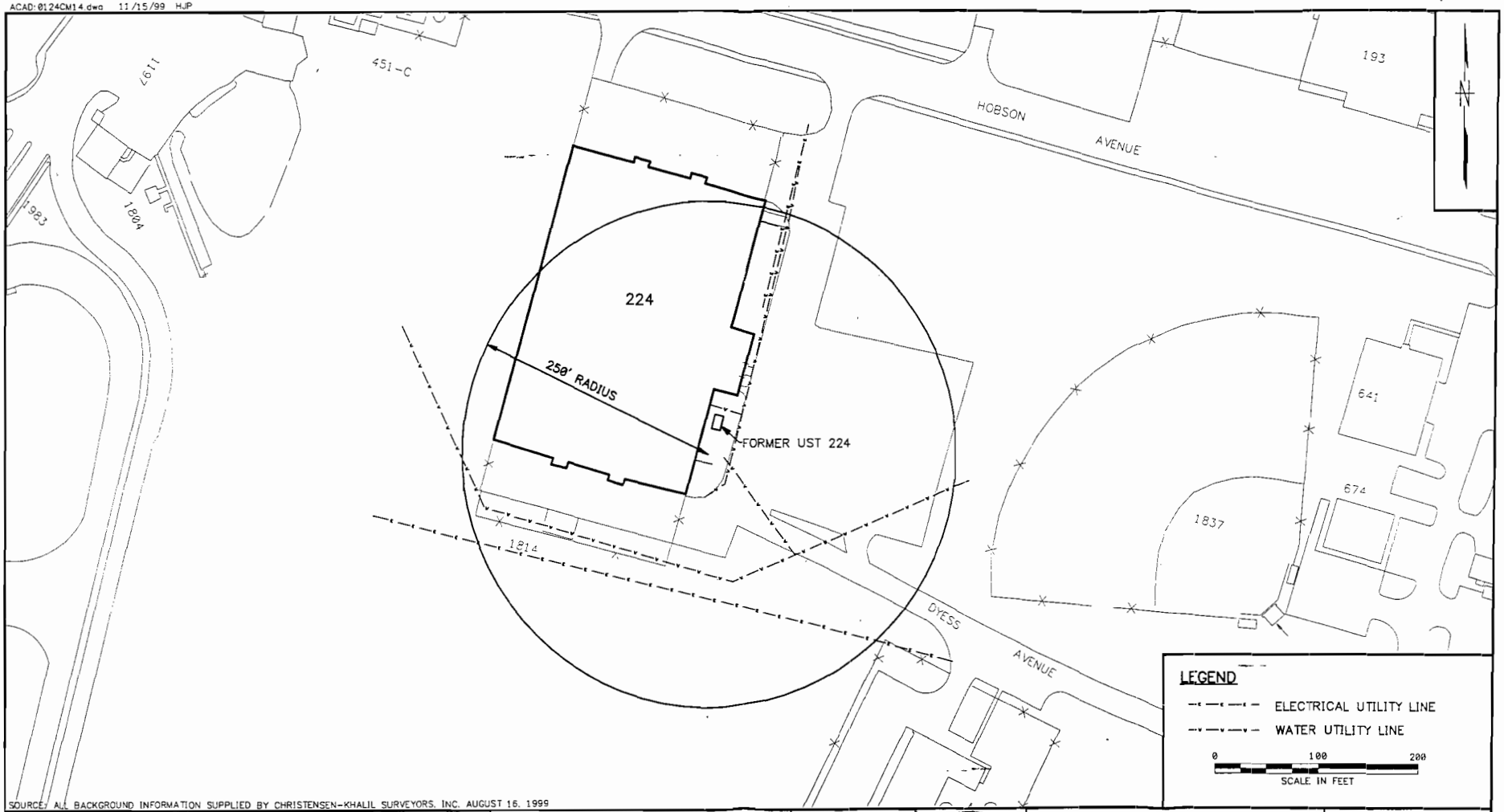
ACAD:0124cm08.dwg 08/20/99 HJP

SOURCE: QUADRANGLE MAP SOUTH CAROLINA, REVISED 1979
QUADRANGLE MAP NORTH CHARLESTON REVISED, 1979

DRAWN BY HJP DATE 8/20/99	SITE LOCATION MAP SITE 16, BUILDING 224 ZONE G, CHARLESTON NAVAL COMPLEX NORTH CHARLESTON, SOUTH CAROLINA	CONTRACT NO. N0124	
CHECKED BY DATE		APPROVED BY DATE	
COST/SCHED–AREA		APPROVED BY DATE	
SCALE AS NOTED		DRAWING NO. FIGURE 1	REV. 0

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

ACAD: 0124CM14.dwg 11/15/99 HJP



SOURCE: ALL BACKGROUND INFORMATION SUPPLIED BY CHRISTENSEN-KHALIL SURVEYORS, INC. AUGUST 16, 1999

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DATE: HJP 8/24/99
CHECKED BY DATE:
COST/SCHED-AREA:
SCALE: AS NOTED

SITE VICINITY MAP
SITE 16, BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0124
APPROVED BY DATE:
APPROVED BY DATE:
DRAWING NO. FIGURE 2
REV. 0

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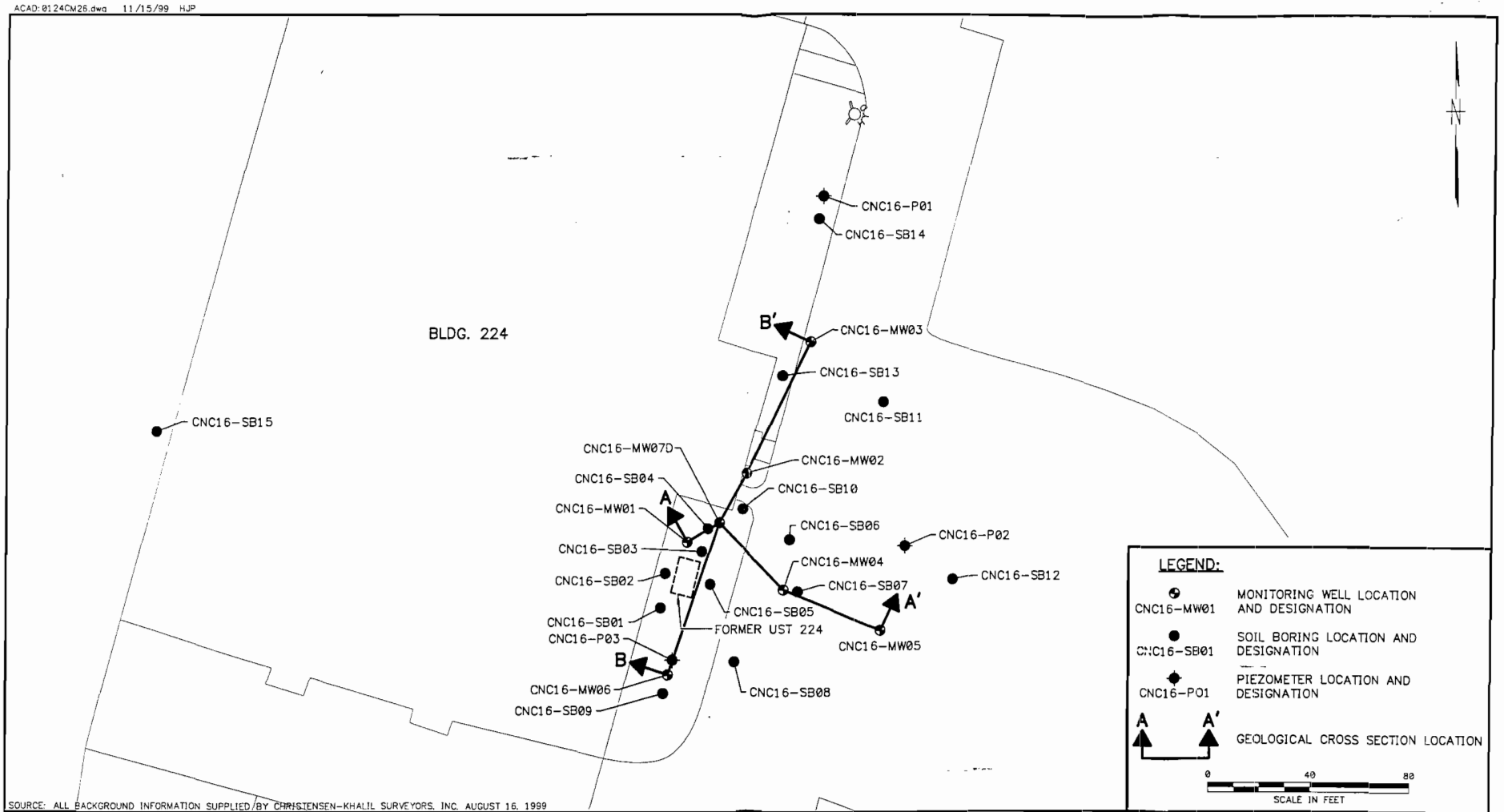


SOURCE: ALL BACKGROUND INFORMATION SUPPLIED BY CHRISTENSEN-KHALIL SURVEYORS, INC. AUGUST 16, 1999

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

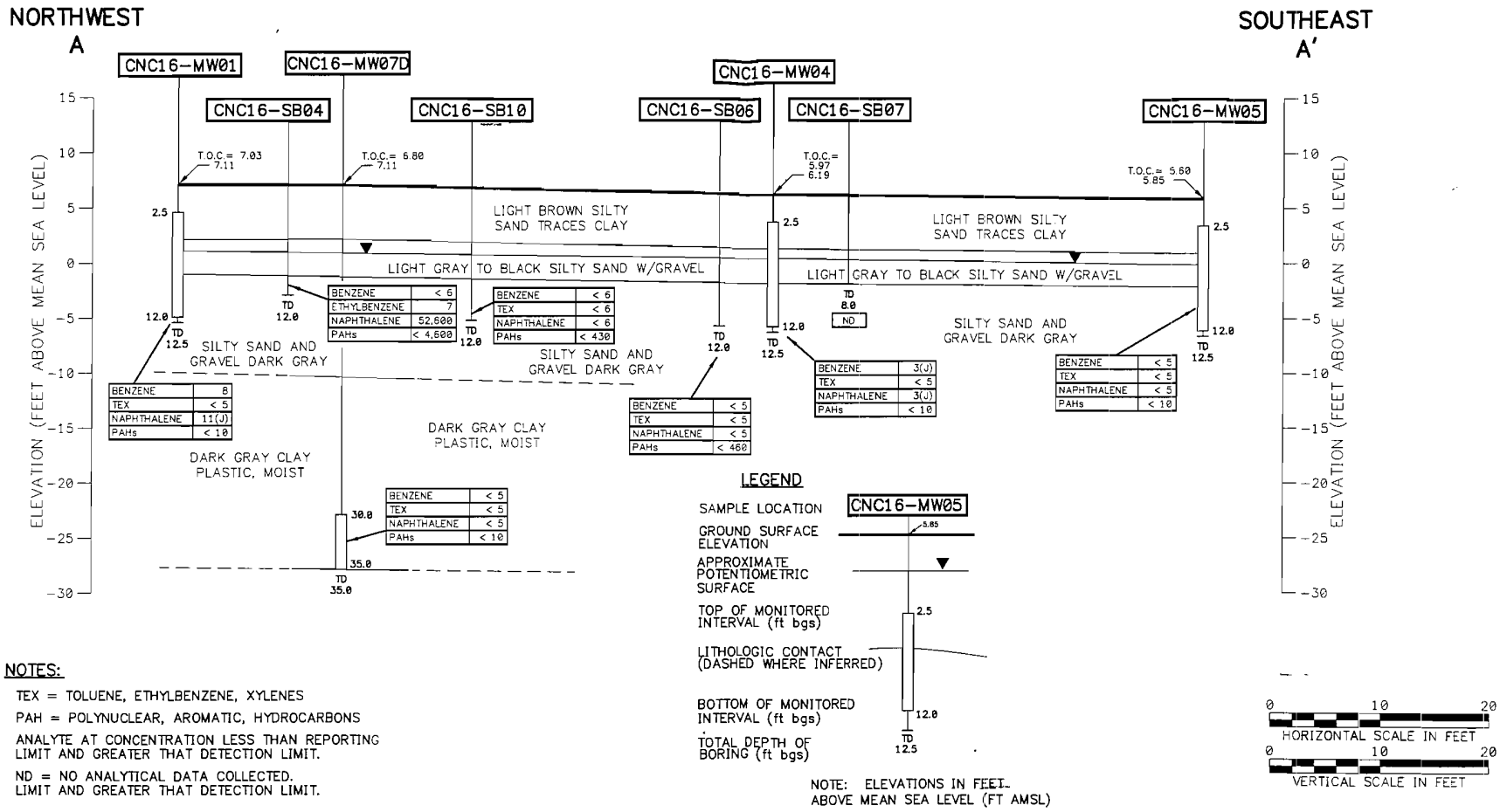
DRAWN BY MF DATE 10/20/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

DEPARTMENT OF THE NAVY NAVFAC ENGINEERING COMMAND

SITE MAP AND SAMPLING LOCATIONS
SITE 16 BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0124
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 3
REV. 0

FORM CADD NO. SDN_BH.DWG - REV 0 - 1/20/98



NOTES:

1) TEX = TOLUENE, ETHYLBENZENE, XYLENES
2) PAH = POLYNUCLEAR, AROMATIC, HYDROCARBONS
3) ANALYTE AT CONCENTRATION LESS THAN REPORTING LIMIT AND GREATER THAT DETECTION LIMIT.
4) ND = NO ANALYTICAL DATA COLLECTED. LIMIT AND GREATER THAN DETECTION LIMIT.

NOTE: ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (FT AMSL)

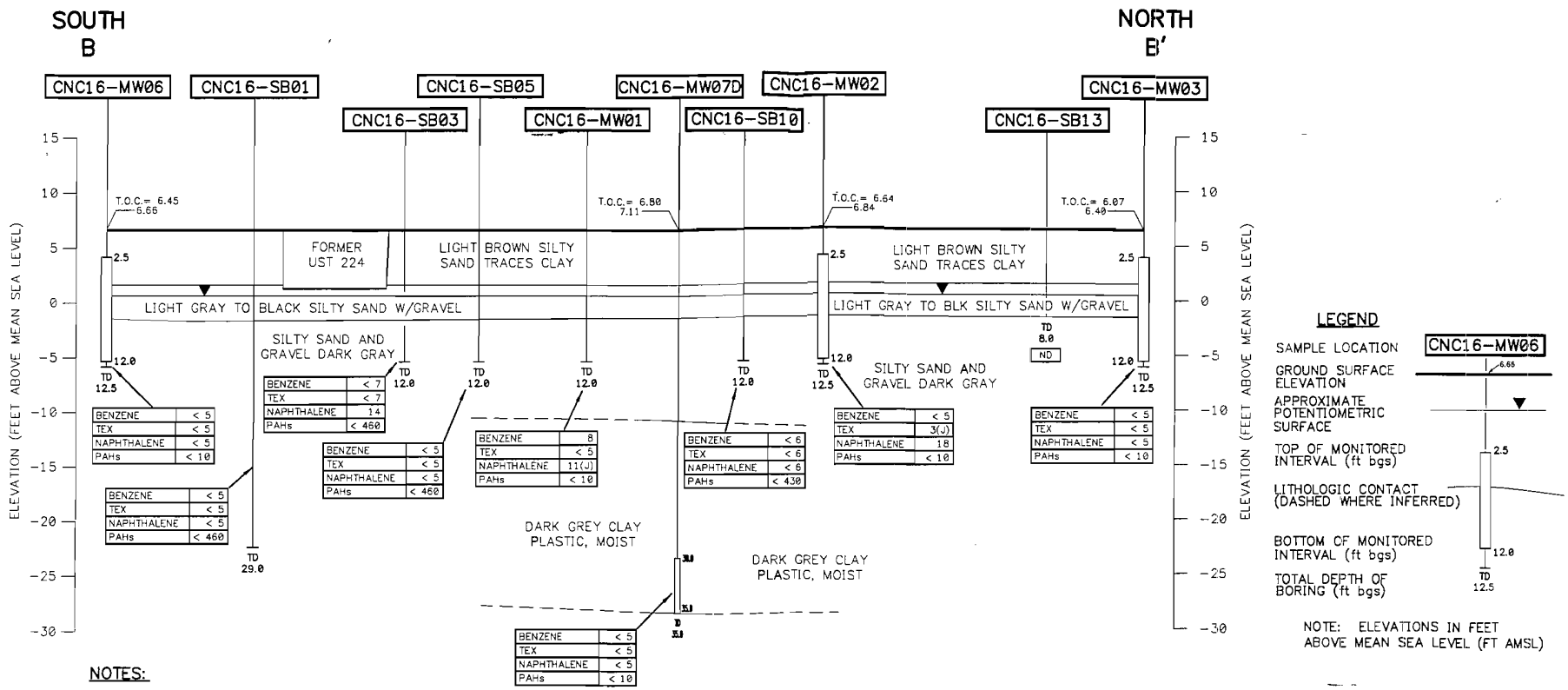
NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 10/20/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

GEOLOGIC CROSS SECTION A-A'
SITE 16, BUILDING 224
ZONE G CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0124
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 4
REV. 0

ACAD:0124GX04.dwg 12/14/99 MF



LEGEND

SAMPLE LOCATION — CNC16-MW06

GROUND SURFACE ELEVATION — 6.65

APPROXIMATE POTENTIOMETRIC SURFACE

TOP OF MONITORED INTERVAL (ft bgs) — 2.5

LITHOLOGIC CONTACT (DASHED WHERE INFERRED)

BOTTOM OF MONITORED INTERVAL (ft bgs) — 12.0

TOTAL DEPTH OF BORING (ft bgs) — TD 12.5

NOTE: ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (FT AMSL)

NOTES:

1) TEX = TOLUENE, ETHYLBENZENE, XYLENES
2) PAH = POLYNUCLEAR, AROMATIC, HYDROCARBONS
3) ANALYTE AT CONCENTRATION LESS THAN REPORTING LIMIT AND GREATER THAT DETECTION LIMIT.
4) ND = NO ANALYTICAL DATA COLLECTED. LIMIT AND GREATER THAT DETECTION LIMIT.

0 20 40
HORIZONTAL SCALE IN FEET

0 10 20
VERTICAL SCALE IN FEET

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 10/20/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

GEOLOGIC CROSS SECTION B--B'
SITE 16, BUILDING 224
ZONE G CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0124
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 5
REV. 0

FORM CADD NO1 SDIV_BK.DWG - REV 0 - 1/20/98

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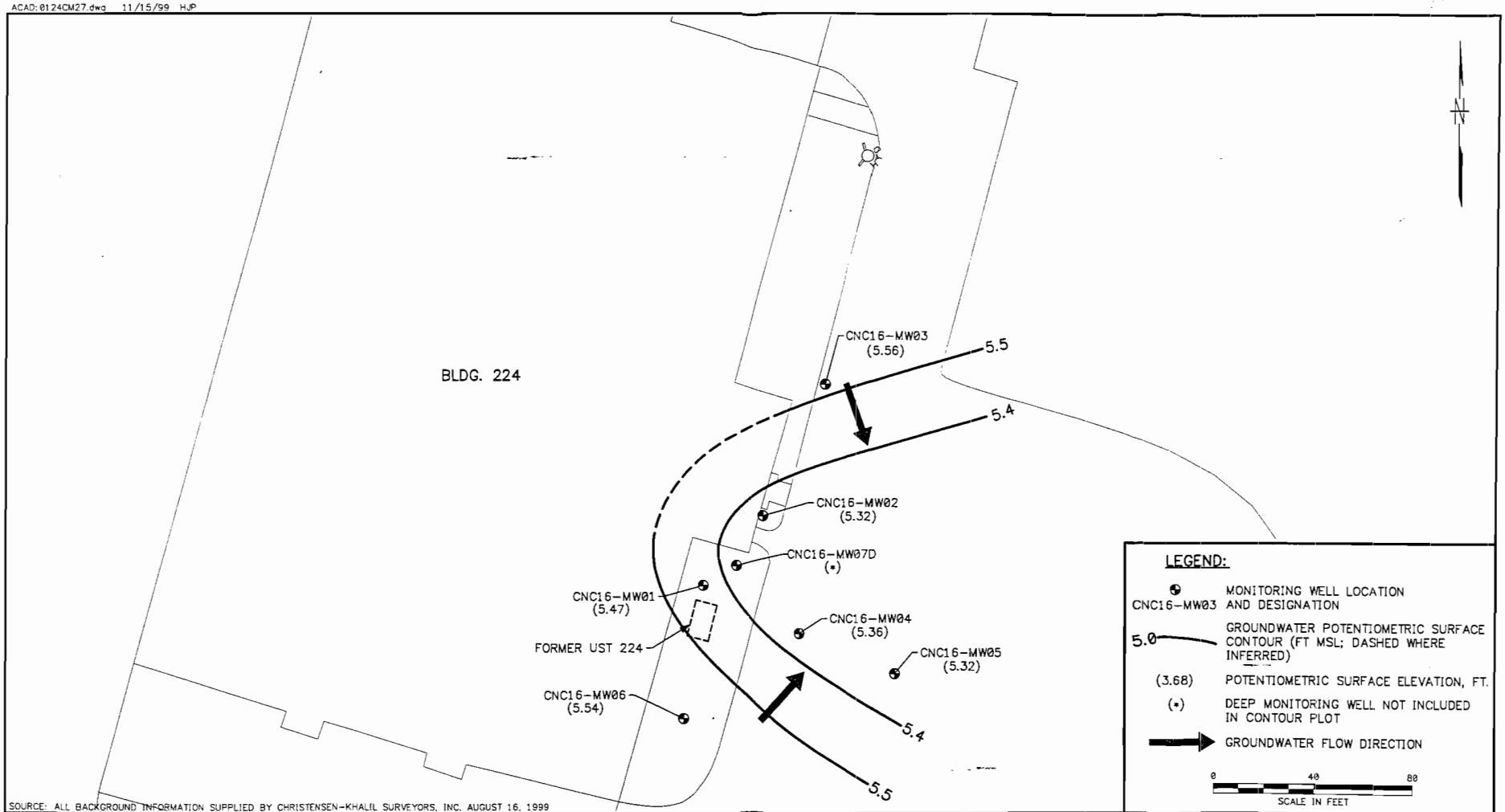

SOURCE: ALL BACKGROUND INFORMATION SUPPLIED BY CHRISTENSEN-KHALIL SURVEYORS, INC. AUGUST 16, 1999

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 10/20/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

GROUNDWATER POTENTIOMETRIC MAP
(JULY 22, 1999)
SITE 16 BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0124
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 6
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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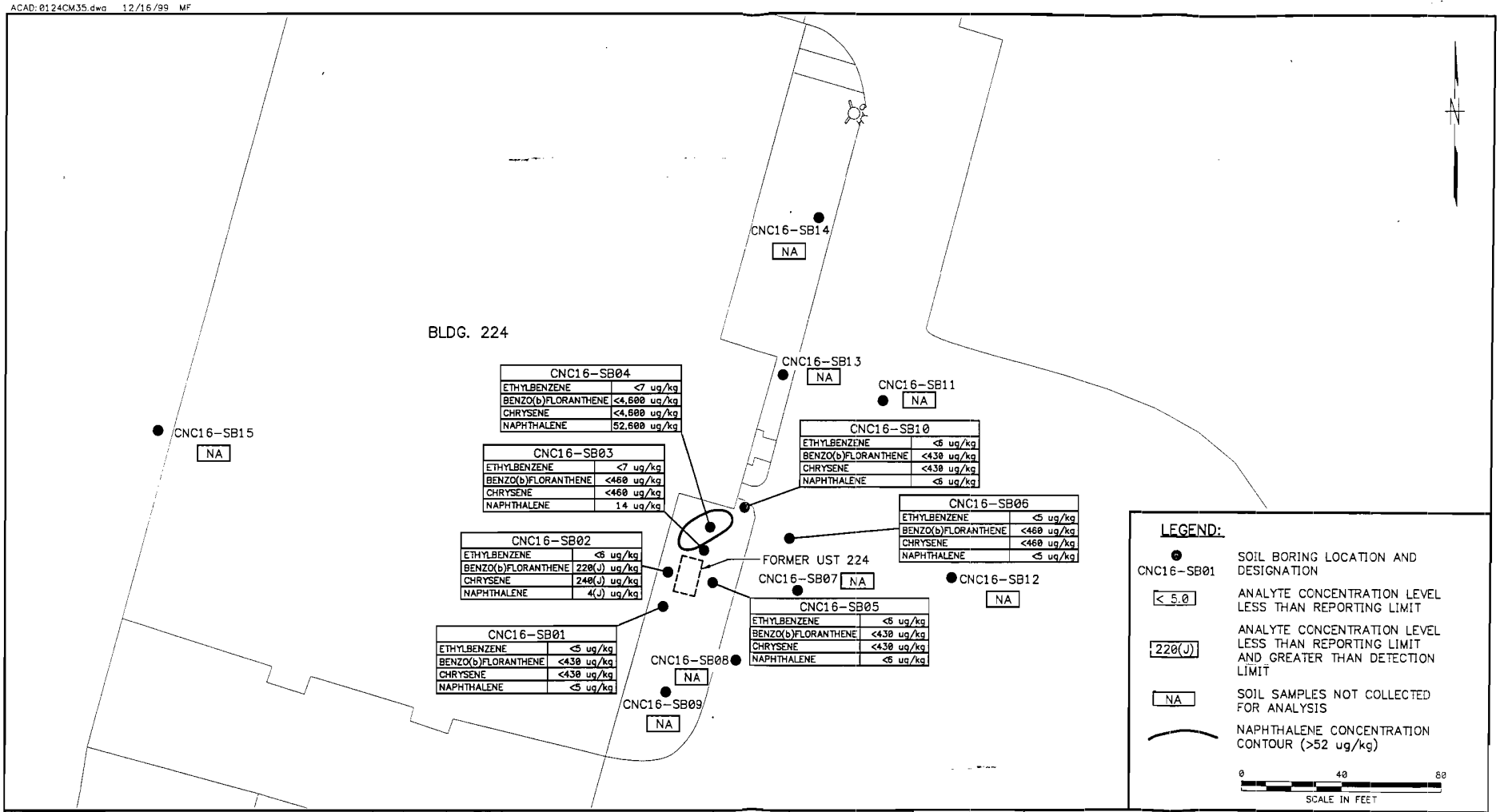

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 12/14/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

DEPARTMENT OF THE NAVY SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND

SOIL ANALYTE CONCENTRATION MAP (MAY, 1999)
SITE 16 BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0124
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 7
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV D - 1/20/98

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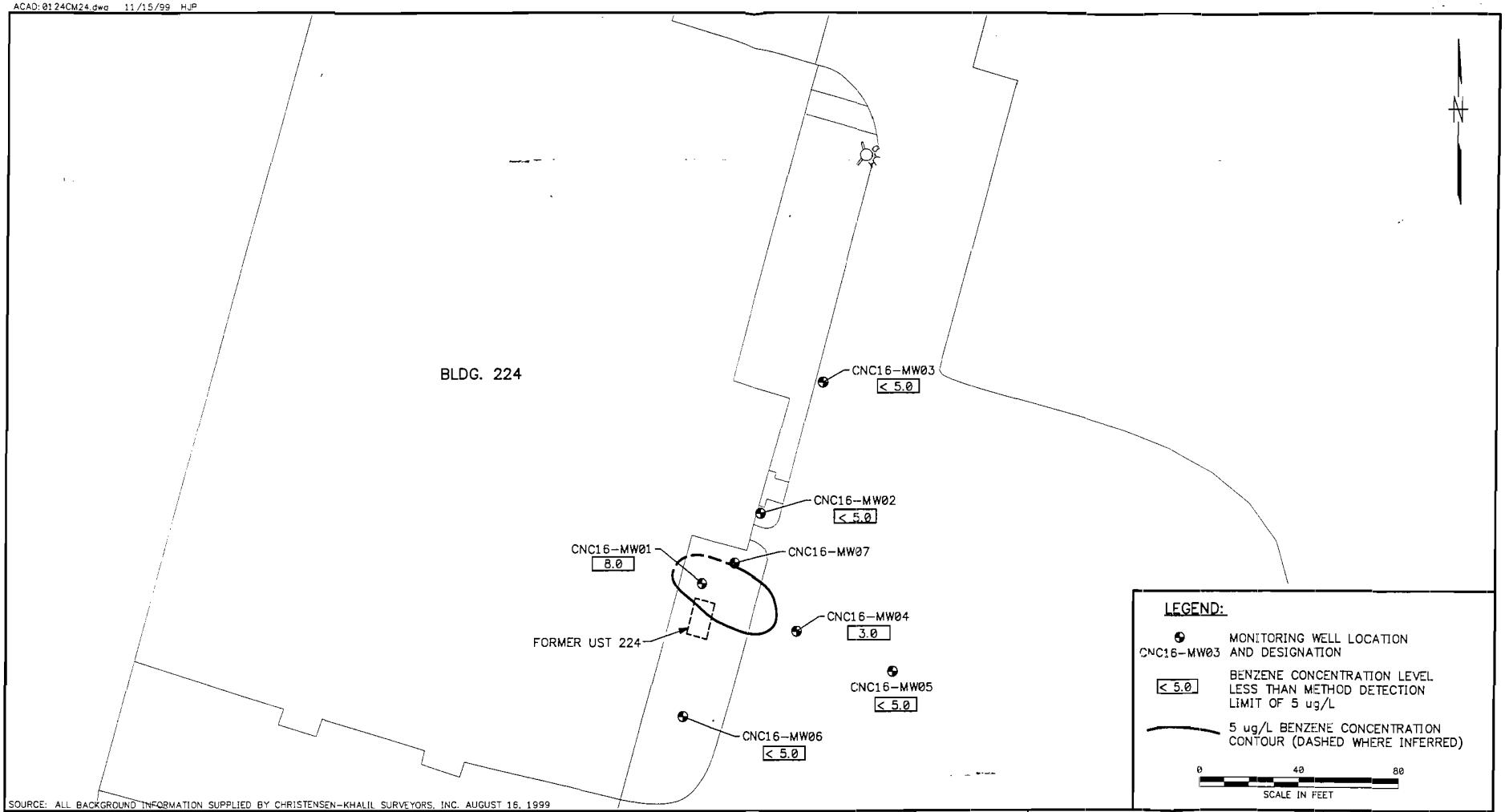

SOURCE: ALL BACKGROUND INFORMATION SUPPLIED BY CHRISTENSEN-KHALIL SURVEYORS, INC. AUGUST 16, 1999

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 10/20/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

GROUNDWATER BENZENE CONCENTRATION MAP (JULY 20, 21, 1999)
SITE 16 BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0124
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 8
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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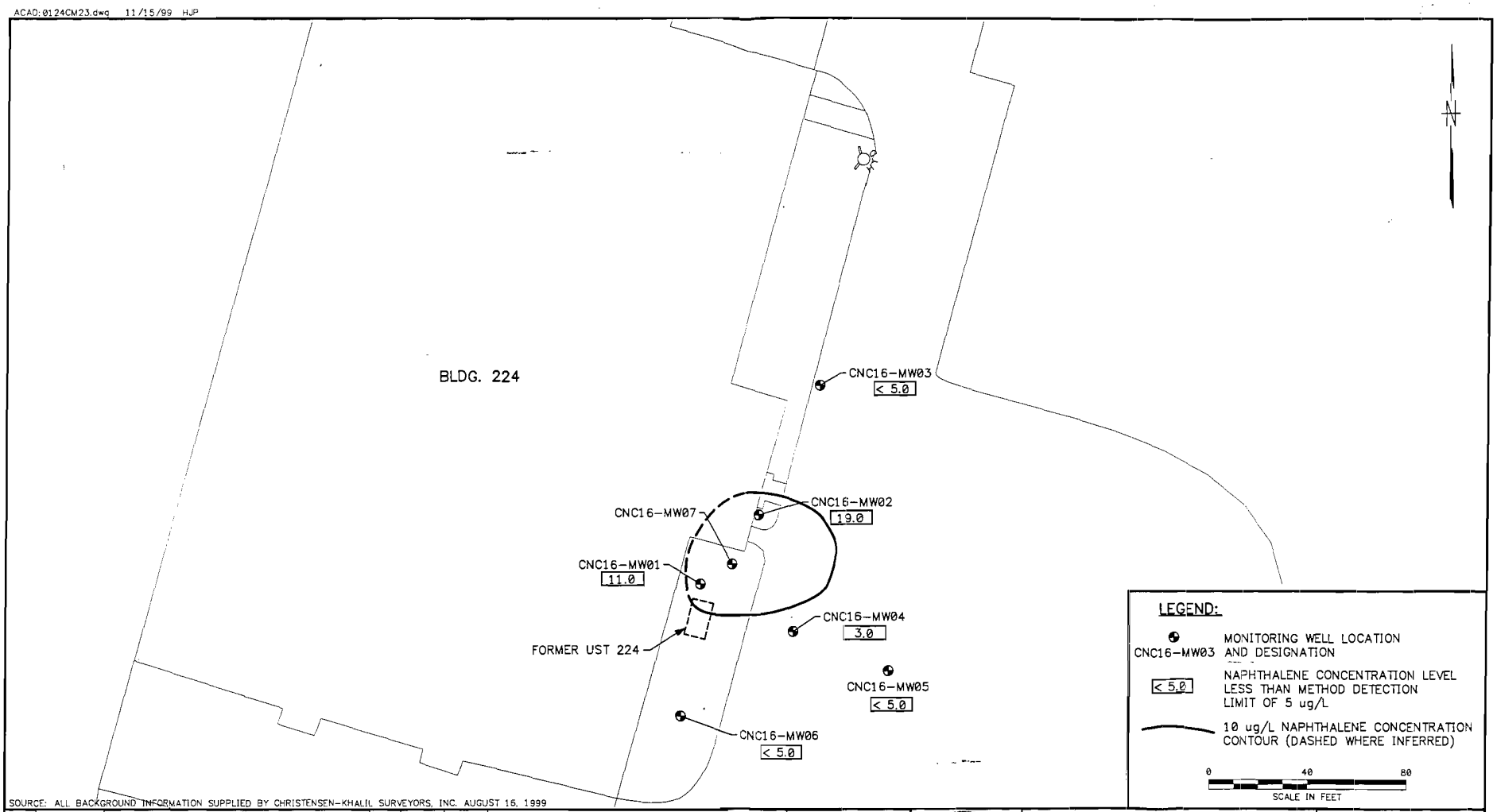


SOURCE: ALL BACKGROUND INFORMATION SUPPLIED BY CHRISTENSEN-KHALIL SURVEYORS, INC. AUGUST 16, 1999

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 10/19/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

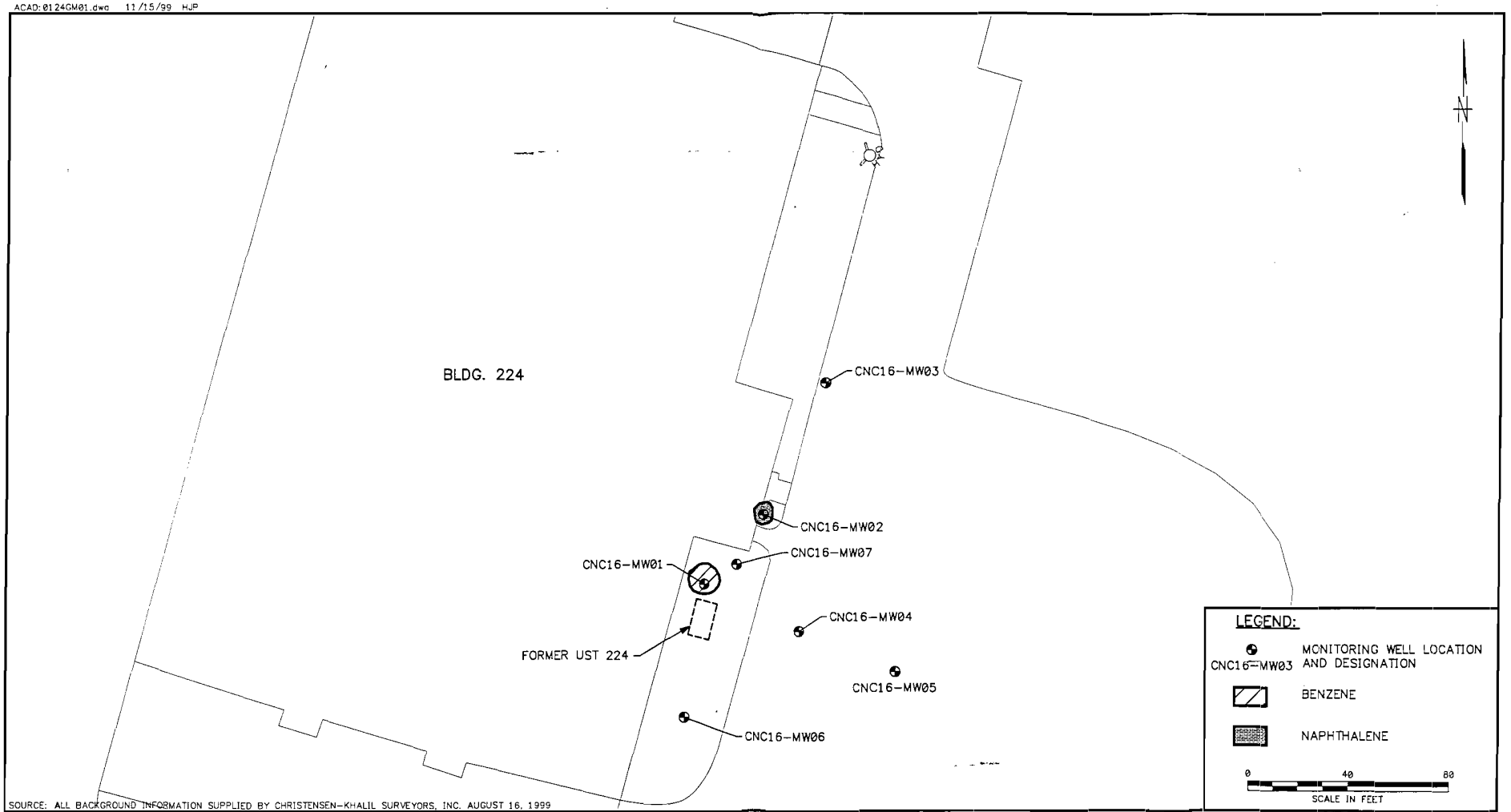
DEPARTMENT OF THE NAVY SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND

GROUNDWATER NAPHTHALENE CONCENTRATION MAP (JULY 20, 21, 1999) SITE 16 BUILDING 224 ZONE G, CHARLESTON NAVAL COMPLEX NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0124
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 9
REV. 0

FORM CADD NO. SDIV_BH.DWG – REV 0 – 1/20/98

ACAD: 0124GM01.dwg 11/15/99 HJP



SOURCE: ALL BACKGROUND INFORMATION SUPPLIED BY CHRISTENSEN-KHALIL SURVEYORS, INC. AUGUST 16, 1999

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

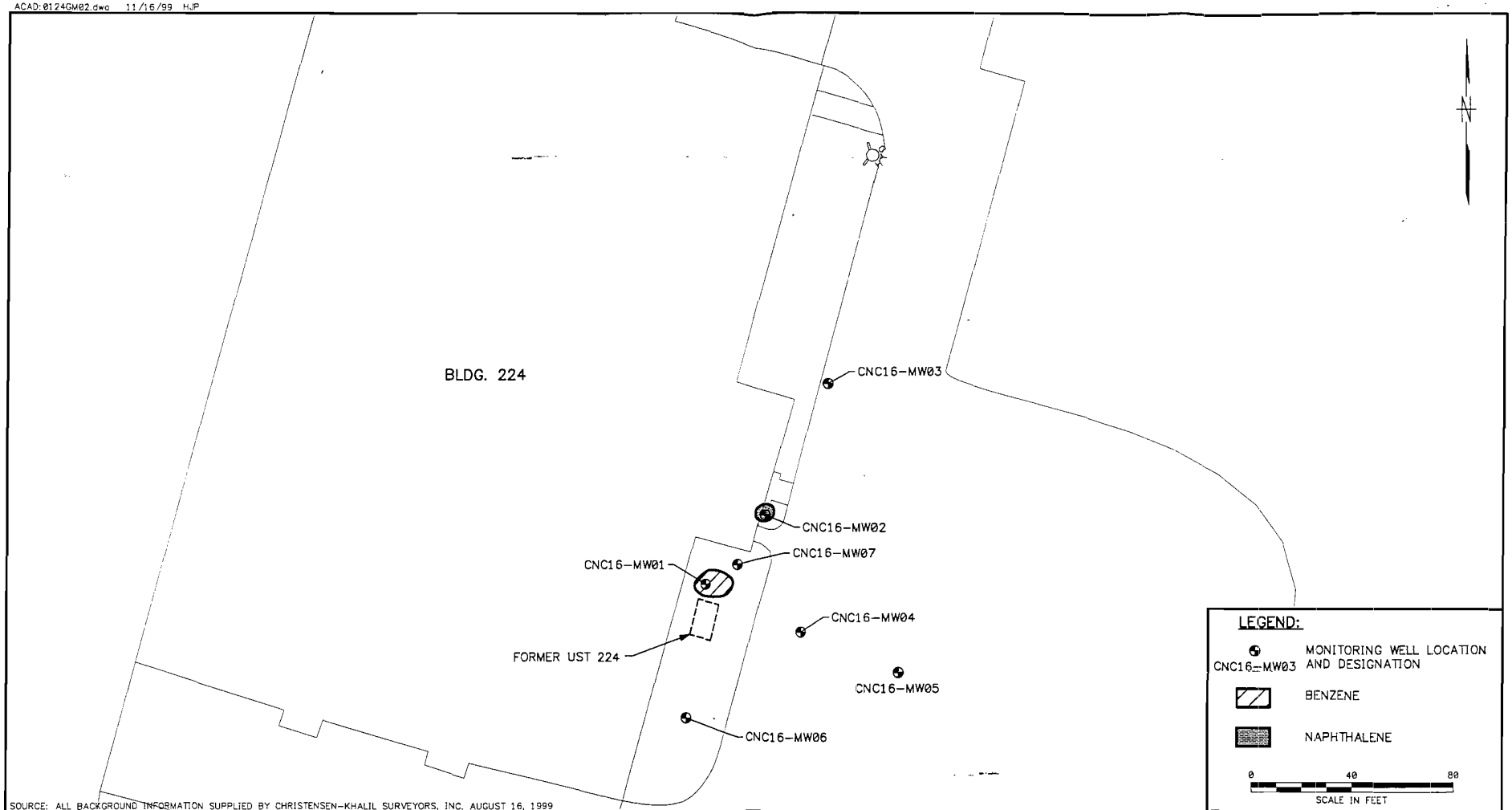
DRAWN BY DATE: HJP 10/20/99
CHECKED BY DATE:
COST/SCHED-AREA:
SCALE: AS NOTED

PREDICTED 10-YEAR MIGRATION
SITE 16 BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0124
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 10
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

ACAD:0124GM02.dwg 11/16/99 HJP



SOURCE: ALL BACKGROUND INFORMATION SUPPLIED BY CHRISTENSEN-KHALIL SURVEYORS, INC. AUGUST 16, 1999

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY HJP DATE 10/20/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

PREDICTED 20-YEAR MIGRATION
SITE 16 BUILDING 224
ZONE G, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0124
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 11
REV. 0

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